CLAIMS

1. A method of friction plunge riveting work parts together with friction stir rivets each having an upper drive head and a shank portion depending therefrom comprising the steps of mounting said rivets in rest positions in a support defining a supply station so that the heads thereof are externally accessible and the shank portions thereof rotatably mount into the support, moving a rotating rivet gripping and installation tool from a start position into operative drive engagement with said head portion of a selected one of said rivets for rotating said selected rivet in said support, operating said tool for removing said selected rivet from said support while continuously rotating said selected rivet, subsequently moving said selected rivet to a work station and into frictional engagement with said work parts to effect the penetration of said work parts with the shank portion thereof by frictional heating and plasticizing of a zone of material therein that extends around said shank portion penetrating said work parts, and releasing said selected rivet from said tool while said tool is rotating and allowing said rivet to diminish in rotational speed to zero while said material of said plasticized zone solidifies around said shank to complete the friction plunge riveting of said work parts together with said selected rivet

2. The method of friction stir riveting of claim 1 and then further comprising the step of moving said rotating rivet gripping and installation

tool back to said supply station and into operative drive engagement with another selected one of said rivets to initiate another friction plunge riveting of said work parts together.

3. A method of friction stir riveting overlapping metal parts together at a work station with friction stir rivets each having a drive head and a said shank portion depending therefrom comprising the steps of mounting a plurality of friction stir rivets in rest positions for subsequent rotation and pickup with respect to a support defining a supply station so that the heads thereof are externally accessible and the shank portions thereof depending therefrom rotatably mount into said support, moving a rotating rivet gripping and apply tool from a start position into operative engagement with the head portion of a selected one of said rivets to grip and rotate said selected rivet while in said supply station, operating said rotating rivet gripping and apply tool to move said selected rivet to said work station so that the shank portion thereof is in loaded frictional contact with the upper surface of said overlapping metal parts at said work station, continuing the rotation of said rivet under load to effect the penetration of said shank portion of said rivet into said parts effecting limited plasticizing of material thereof in a frictionally heated zone extending around said shank portion and releasing said rivet from said rotating gripping and apply tool to allow said rivet to diminish in rotational speed to zero and said plasticized material to

fully solidify around said shank of said rivet so that said parts are securely friction stir riveted together.

4. The method set forth in claim 3 and further comprising the step of automatically cycling said tool from said work station back to said supply station while said tool is rotating to target rotate and pick up a second rivet therefrom and cycling said rotating tool with said second rivet aboard back to said work station and into loaded frictional contact with said overlapped parts for the joining of said parts with said second rivet by friction stir riveting..

5. The method set forth in claim 3 wherein said application tool has opposing jaws movable between open head receiving and closed head gripping positions, each of said rivets have profiled heads and a centered drive and shaped drive associated therewith, and wherein said application tool has a depending driver rotatable therewith and terminating in a driving end for operatively engaging said centered and shaped drive and further comprising the step of rotatable driving said rivet from shared input torque from said driving end and from said opposing jaws of said gripping application tool.

6. A machine for the serial selection of discrete friction stir fasteners from a plural supply thereof and for the subsequent frictional

driving of such fasteners into the material of overlapped parts to join said parts to one another by friction stir riveting comprising a main housing, an arm supported within said housing for movement to a plurality of adjusted position, said arm having a rotating drive shaft adjacent the free end thereof, said drive shaft mounting a pair of opposing gripping jaws operatively mounted thereon and extending there from, a drive mechanism for rotating said drive shaft and said associated gripping jaws, a movable actuator for selectively opening and closing said jaws, a screwdriver bit associated with said shaft and located between said jaws for selectively torquing said friction stir rivet.

7. A machine for the serial selection of individual friction stir fasteners from a fungible supply thereof and for subsequently individually directly driving such fasteners into overlapped metal parts to plasticize zones of material of said overlapped metal parts to join said parts to one another by friction plunge fastening, each of said fasteners having a driving head and a shank depending therefrom, comprising a robotic arm having a free end supported for universal movement , said arm having a rotating drive head adjacent the free end thereof, said drive head operatively mounting a pair of opposing gripping jaws movable between open head- receiving and closed head- gripping position, said head further having a centralized rivet drive extending therefrom to a terminal bit located between said opposing gripping jaws, a mechanism for rotating said drive head and said associated gripping

jaws and said centralized rivet drive , and an actuator associated with said head for selectively opening and closing said jaws to receive and drivingly grip said driving head of rivet selected by said machine.

8. A power tool for the pick up and drive of fasteners each having an upper drive head and a shank portion depending therefrom, said drive head having discrete inner and outer profiled drive surfaces comprising a centralized support member selectively powered for continuous rotation about a centralized axis of revolution, a pair of elongated and opposing arms pivotally connected at one end to said centralized support member for swinging movement toward and away from one another, an actuator associated with said support member for effecting the swing movement of said arms, said arms having free ends defining opposing jaws selectively engagable with said outer profiled drive surfaces of said drive, a fastener drive member extending from said rotatable support member for turning movement therewith about said axis, said fastener drive member having a free end defining a driver for operative engagement with said inner drive surface while said jaws operatively engage said outer drive surfaces of one of said fasteners for rotation and pick up of a selected one of said fasteners and the rotatable thereof to effect fastening therewith.

9. The power tool of claim 8 wherein said jaws face inwardly toward one another and wherein said actuator is operative to move said arms

toward one another so that said inwardly facing jaws grip said profiled outer drive surfaces of said drive head of said selected one of said fasteners.

10. The power tool of claim 8 wherein said jaws face outwardly from one another and wherein said actuator is operative to move said arms away from one another so that said jaws operatively engage said outer profiled drive surfaces of said drive head of said selected one of said fasteners.

11. A system for selecting and picking up friction stir rivets at a supply station and rotatably driving and displacing said selected friction stir rivets to riveting positions in which work piece components are friction stir riveted together, each of said rivets having a enlarged head with a drive tool recess therein and a shank portion depending there from comprising a support, a robotic arm movably mounted on said support, said arm having a working end displaceable to an infinite number of working positions, said working end having a rotatable rivet driving output shaft associated therewith that terminates in a drive end portion for drivingly engaging said drive tool recess formed in said head of said rivet, a gripping jaw unit operatively mounted on said output shaft above said drive end portion, said gripping jaw unit comprising first and second opposing gripping arms having opposing jaws at the free ends thereof and movable between open position for receiving and releasing said enlarged head portion and a closed position for

gripping said head portion, said arms having upper ends pivotally mounted on said output shaft, an actuator operatively mounted on said output shaft for moving said arms and said jaws between a first position in which said gripping jaws are drivingly engaging said head of said friction stir rivet for driving said rivet and a second position in which said jaws are released from the rotational drive of said friction stir rivet.

12. The system of claim 11 wherein said working end incorporates an elongated probe for contacting said drive tool recess, and controls associated with said probe for effecting the operative closure of said jaws in response to the operative contact of said probe with said recess.